

Amend  
film containing any one of Cu, Ni, Sn, Au, Ag, Cr, or Pd or the low-resistance metal film is a multilayer film containing at least one single layer film containing Cu, Ni, or Au.

Kindly add new claim 15, as follows:

A2  
15. (new) The method according to claim 1, wherein the ground resin film has a thickness of between 0.05  $\mu\text{m}$  and 0.5  $\mu\text{m}$ .

### REMARKS

Claims 1- 14 are pending in the subject application. Claim 1 has been amended, claims 3 and 10 have been cancelled without prejudice and new claim 15 has been introduced. Support for the amendment to claim 1 may be found at page 18, lines 23-25. Support for new claim 15 may be found, for example, at page 13, line 11 to page 14, line 3. No new matter has been introduced by the instant amendment. Favorable reconsideration in light of the amendments and remarks which follow is respectfully requested.

An English language translation of the Korean Office Action referenced in the August 5, 2002 Information Disclosure Statement is enclosed for the consideration of the Examiner. Applicants note that the Korean patent publication 1993-18660 is part of the patent family comprising U.S. Patent 5,300,813, both of which were filed as part of the August 5, 2002 IDS and that Korean publication 1993-18660 and U.S. Patent 5,300,816 provide substantially the same disclosure. Thus Applicants respectfully submit that the IDS complies with all of the requirements of rule 37 CFR 1.98 including the provisions of rule 1.98(a)(3).

Claims 1-14 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

Applicants have amended claim 1 and cancelled claims 3 and 10. Applicants believe that the claims as amended are fully compliant with all of the provisions of 35 U.S.C. §112 including 35 U.S.C. §112, second paragraph.

Thus, it is respectfully requested that the rejection under §112 be withdrawn. It is respectfully submitted that claims 1-14 meet the requirements under 35 U.S.C. §112.

Claims 1-4 and 6-14 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Joshi in view of JP 10-245,444.

Claims 1-4 and 6-14 have been rejected under 35 U.S.C. §103(a) as being unpatentable over the combination of Joshi, JP 10-245,444 and Larsson (U.S. Patent 6,303,278 B1).

Claims 1-13 have been rejected under 35 U.S.C. §103(a) as being unpatentable over the combination of Joshi, JP 10-245,444 and Iwasaki (U.S. Patent 5,323,534).

For the sake of brevity, the three § 102 and § 103 rejections are addressed in combination. Such a combined response is considered appropriate because *inter alia* each of the rejections relies on the Joshi patent as the primary citation. Each of the rejections is traversed.

The present invention provides methods of forming a low-resistance metal film selectively one and over a patterned ground resin film by a wet film formation technique. For example, a low-resistance metal film may be formed on and over a patterned polyimide ground resin film by contacting the patterned film with a liquid plating solution. Thus the metal film is deposited over the entirety of the patterned polyimide resin such that no polyimide resin is left exposed. See, for example, Figure 1C, 1D, and 3C.

Claim 15 provides a method of claim 1 which is suitable for formation of metal lines having a ground resin film of between 0.05 and 0.5  $\mu$  which prevents a variety of performance problems including disconnections at wiring jumping or cracks at the edge portion of the metal wirings for active matrix drive type LCD. Moreover the metal lines prepared by the method of claim 15 have a ground resin film of at least 0.05  $\mu$ m which prevents loss of adhesion between

the substrate and the ground resin and prevents dissipation of the ground film due to substrate variability.

Joshi teaches methods for forming metal filled vias and conductor lines on a substrate which comprise a low resistivity metal capped with a corrosion resistant refractory metal. Joshi neither discloses nor suggests methods of manufacturing metal wirings comprising the steps of (a) applying an ground resin to an insulating substrate; (b) patterning the ground resin film; and (3) forming a low-resistance metal film on the patterned ground resin film.

Moreover, Joshi appears to teach plating a metal film onto a substrate polyimide film and then patterning the plated polyimide film. Consequently, at least a portion of the polyimide film is not covered with the plating film, e.g., edges of the layered polyimide/metal structure formed during patterning have exposed polyimide material.

The Dalton reference discussed in Background section of Joshi also fails to teach the methods of fabricating metal lines of the present invention. As the Dalton reference is described by Joshi, Dalton teaches the deposition of a passivation dielectric layer (such as SiO<sub>2</sub> or a polyimide) onto a **conductive** substrate, e.g., a substrate having a laminate of an aluminum layer and a TiW layer deposited thereon. Thus, the methods recited by Dalton include the step of depositing a polyimide on a conductive substrate.

Claim 1 is patentable over the disclosure of Joshi. More particularly, claim 1 provides a method of forming a metal wire comprising depositing a ground resin layer onto an **insulating** substrate. Claims 2-4 and 6-14 depend from claim 1 and are therefore also patentable over Joshi.

The supporting documents, i.e., JP 1-245,444 and Larsson, are unable to overcome the limitations of Joshi.

The 444 reference teaches a method of forming a conductive coating layer on a non-conductive polyimide substrate in which a polyimide substrate is sulfonated, neutralized, contacted with a metal ion. The metal ions in contact with the sulfonated polyimide substrate are

reduced to form a metallic conductive layer on the surface of the non-conductive layer. The 444 reference teaches deposition of a metal layer on a polyimide plate substrate.

The 444 reference merely teaches methods for fabricating conductive metal layers on a non-conductive surface of a polyimide substrate. As the reference is understood, the 444 reference neither discloses nor suggests deposition of a metal onto an insulating substrate coated with a polyimide layer.

Thus the 444 reference is unable to overcome the limitations of Joshi. More particularly, the 444 reference neither discloses nor suggest the deposition of a low-resistivity metal layer onto a patterned ground resin layer on an insulating substrate.

Thus no combination of Joshi with the 444 reference disclose or suggest to one skilled in the art the metal wire fabrication methods of the present invention which include the formation of a ground resin layer on an **insulating** substrate.

Larsson fails to overcome the limitations of the combined teaching of Joshi and the 444 reference. As the reference is understood, Larsson teaches a method of modifying a surface by grafting a composition to specified portions of the surface, absorbing metal ions onto the grafted composition and then depositing additional metal onto the grafted composition by traditional deposition techniques. More particularly, Larsson neither discloses nor suggests a method of fabricating a metal line or metal wire comprising (a) forming a ground resin film, or (b) patterning the ground resin film.

Similarly, Iwasaki fails to overcome the limitations of the combined teaching of Joshi and the 444 reference. As the reference is understood, Iwasaki merely teaches the incorporation of a plating catalyst into an epoxy adhesive layer. Iwasaki neither discloses nor suggests methods of wire fabrication comprising the steps of forming a ground resin layer on an insulating substrate or patterning the ground resin layer. Thus the combination of Joshi, the 444 reference and Iwasaki does not teach each step of the metal wiring fabrication method of the present invention.

Claim 1 is patentable over any combination of Joshi, the 444 reference and Larsson or Iwasaki. Claims 2-4 and 6-14 depend from claim 1 and are therefore also patentable over the combined teachings of Joshi, the 444 reference and Larsson or Iwasaki.

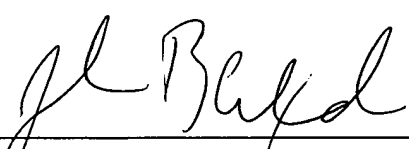
Reconsideration and allowance of claims 1-14 is respectfully requested in view of the foregoing discussion. This case is believed to be in condition for immediate allowance. Applicant respectfully requests early consideration and allowance of the subject application.

If for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge Deposit Account No. 04-1105.

Should the Examiner wish to discuss any of the amendments and/or remarks made herein, the undersigned attorney would appreciate the opportunity to do so.

Respectfully submitted,

Date: February 4, 2003

  
John B. Alexander, Ph.D. (Reg. No. 48,399)  
Dike, Bronstein, Roberts & Cushman  
Intellectual Property Group of  
EDWARDS & ANGELL, LLP  
P.O. Box 9169  
Boston, MA 02209  
Tel. No. (617) 439-4444

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

IN THE CLAIMS

Please cancel claims 3 and 10 without prejudice or disclaimer.

Kindly amend claim 1, as follows:

1. (amended) A method for fabricating metal wirings, comprising the steps of:  
forming a ground resin film by applying a resin onto an insulating substrate;  
patterning the ground resin film; and  
forming a low-resistance metal film selectively on and over the patterned ground resin film by a wet film formation technique, wherein the low-resistance metal film is a single layer film containing any one of Cu, Ni, Sn, Au, Ag, Cr, or Pd or the low-resistance metal film is a multilayer film containing at least one single layer film containing Cu, Ni, or Au.

Kindly add new claim 15, as follows:

15. (new) The method according to claim 1, wherein the ground resin film has a thickness of between 0.05  $\mu\text{m}$  and 0.5  $\mu\text{m}$ .